

CLAIMS

1. An ultrasound applying skin care device comprising:

a housing provided with an applicator head which applies ultrasound to a user's skin; and

a driver circuit which gives an electric pulse for actuating said applicator head to generate the ultrasound;

said applicator head comprising:

a vibrator element generating the ultrasound, and

a horn having a mounting face and a skin opposing face which is adapted in use to come into contact with the skin, said horn carrying said vibrator on said mounting face to transmit said ultrasound to the skin through said skin opposing face, said vibrator element and said horn being integrated into a combined vibration mass which resonates with the electric pulse of a resonant frequency from said driver circuit to generate the ultrasound, said combined vibration mass giving a first electrically equivalent impedance when it is normally loaded by contact with the skin, and gives a second electrically equivalent impedance when it is unloaded,

a load detecting circuit which is connected to monitor whether said combined vibration mass gives the first or second electrically equivalent impedance and provides a load detection signal only upon seeing said first electrically equivalent impedance,

a control circuit which limits or stops the electric pulse when the load detection signal is not received within a predetermined time period,
wherein

said combined vibration mass has a structure that restrains vibrations at a center portion of said combined vibration mass to reduce a parasitic resonance, thereby differentiating said first electrically equivalent impedance from said second electrically equivalent impedance for discrimination therebetween.

2. The ultrasound applying skin care device as set forth in claim 1, wherein said vibrator element comprises a piezoelectric element in the form of a circular disc having flat upper and lower end faces, and upper and lower electrodes respectively deposited on said upper and lower end faces, said electric pulse being applied across said upper and lower electrodes.

3. The ultrasound applying skin care device as set forth in claim 2, wherein at least one of said upper electrode, said lower electrode, and said piezoelectric element has a center opening to restrain the vibrations at the center of said combined vibration mass.

4. The ultrasound applying skin care device as set forth in claim 2, wherein each of said upper electrode, said lower electrode, and said piezoelectric element has a center opening to restrain the vibrations at the center of said combined vibration mass.

5. The ultrasound applying skin care device as set forth in claim 3, wherein at least one of said upper electrode and said electrode has a diameter smaller than that of said piezoelectric element to leave the peripheral portions of the corresponding end face of said piezoelectric element uncovered.

6. The ultrasound applying skin care device as set forth in claim 2, wherein at least one of said upper and lower electrodes is divided by at least one slit into a plurality of identical segments, said at least one slit extending diametrically to leave the center and the diametrically extending band portion of said piezoelectric element uncovered.

7. The ultrasound applying skin care device as set forth in claim 2, wherein at least one of said upper and lower electrodes has at least one slit that uncovers the center portion of said piezoelectric element.

8. The ultrasound applying skin care device as set forth in claim 2, wherein said horn has a center hole for restraining the vibrations at the center of said combined vibration mass.

9. The ultrasound applying skin care device as set forth in claim 3, wherein said horn has a center hole for restraining the vibrations at the center of said

combined vibration mass.

10. The ultrasound applying skin care device as set forth in claim 2, wherein said upper electrode is covered on its center with an elastic member absorbing the vibrations at the center of said combined vibration mass.

11. The ultrasound applying skin care device as set forth in claim 10, wherein said elastic member is a silicone rubber.

12. The ultrasound applying skin care device as set forth in claim 2, wherein said upper electrode of said piezoelectric element is covered on its center with a solder bulk for electrical connection of the upper electrode to a lead wire leading from said driver circuit, the solder bulk adding a weight to the center of the piezoelectric element.

13. The ultrasound applying skin care device as set forth in claim 1, wherein said horn is formed as an integral part thereof with a rim which surrounds said horn and is connected to said housing, said horn and said rim defines therebetween a restrictor which restricts the ultrasound vibrations from propagating towards said rim.

14. The ultrasound applying skin care device as set forth in claim 13 wherein said restrictor is defined by a cavity formed at the boundary between said horn and said rim.

15. The ultrasound applying skin care device as set forth in claim 1, further including:

a motion detecting circuit which monitors whether said combined vibration mass is moving and provides a motion detection signal when said vibration mass is so moving;

said control circuit controlling said driver circuit to stop or limit said electric pulse when said load detection signal is not received within said predetermined time period or when said motion detection signal is not continuous over a critical time duration even in the presence of said load detection signal being detected within said time period.

16. The ultrasound applying skin care device as set forth in claim 1, wherein said control circuit receives said first electrically equivalent impedance in order to vary the intensity of the ultrasound generated at said vibrator element in accordance with the magnitude of said first electrically equivalent impedance.